ELECTRONIC EQUIPMENT

TECHNICAL FIELD

[0001] The present invention relates to a cooling structure for heat generating components of electronic equipment.

BACKGROUND ART

[0002] In some cases, in electronic equipment, a heat radiating apparatus such as a heatsink or a heat pipe is connected to an integrated circuit apparatus such as a central processing unit (CPU) or a graphics processing unit (GPU). In conventional electronic equipment, an integrated circuit apparatus is disposed on an upper side of a circuit board with a heat radiating apparatus provided above the integrated circuit apparatus (e.g., Japanese Patent Laid-Open No. 2013-222275).

SUMMARY

[0003] In conventional electronic equipment, there have been cases in which the heat radiating apparatus constitutes a constraint in laying out other components and in which a cooling structure increases in size to provide sufficient cooling performance.

[0004] Electronic equipment proposed in the present disclosure includes a circuit board, a heat radiating apparatus, and heat conduction paths. The circuit board has first and second surfaces and through holes. An electronic component is disposed on the first surface. The second surface is on the opposite side of the first surface. The circuit board has through holes formed in an area where the electronic component is disposed. The heat radiating apparatus is disposed on the second surface of the circuit board and is located on the opposite side of the electronic component with the circuit board provided therebetween. The heat conduction paths are provided in the through holes of the circuit board and connect the electronic component and the heat radiating apparatus. The electronic equipment ensures a higher degree of freedom in a component layout or enhances cooling performance for the electronic component.

BRIEF DESCRIPTION OF DRAWINGS

[0005] FIG. **1** is a schematic sectional view illustrating an example of electronic equipment proposed in the present disclosure.

[0006] FIG. **2**A is an enlarged sectional view of a circuit board included in the electronic equipment illustrated in FIG. **1**.

[0007] FIG. **2**B is a plan view illustrating an area where heat conduction paths illustrated in FIG. **2**A are formed.

[0008] FIG. **3** is a sectional view illustrating a modification example of the heat conduction paths formed in the circuit board illustrated in FIG. **2**A.

[0009] FIG. **4** is a plan view illustrating another modification example of the heat conduction paths illustrated in FIG. **2**A.

[0010] FIG. **5** is a sectional view illustrating a modification example of the circuit board illustrated in FIG. **2**A.

[0011] FIG. **6** is a sectional view illustrating a modification example of through holes and the heat conduction paths illustrated in FIGS. **1** and **2**A.

[0012] FIG. **7** is a plan view illustrating a modification example of the circuit board illustrated in FIGS. **1** and **2**A.

DESCRIPTION OF EMBODIMENT

[0013] A description will be given below of an embodiment of electronic equipment proposed in the present disclosure. In the description given below, directions indicated by Z**1** and Z**2** in FIG. **1** will be referred to as upper and lower, respectively. In the description given below, the terms "upper," "lower," "upper side," "lower side," and so on are used to indicate a relative positional relationship between components, members, and elements of the electronic equipment. These terms do not restrict postures of the components and so on in the electronic equipment or the posture of the electronic equipment.

[0014] As illustrated in FIG. **1**, electronic equipment **1** has a circuit board **10**. The circuit board **10** has a base material **10***a* that includes, for example, an insulating material such as paper phenol, glass epoxy resin, and so on. Circuit patterns **15** (refer to FIG. **2**A) are formed in the base material **10***a*. The circuit board **10** is a multi-layer board having a plurality of layers with the circuit pattern **15** formed in each layer. The circuit board **10** may not be a multi-layer board. For example, the circuit board **10** may be a double-sided board having the circuit pattern **15** only on its upper and lower surfaces. Alternatively, the circuit board **10** may be a one-sided board with the circuit pattern **15** formed only on its upper surface (surface on which an integrated circuit apparatus or another component is mounted).

[0015] In the example of the electronic equipment **1**, the circuit board **10** has a hole h**2** that connects the plurality of circuit patterns **15** with each other as illustrated in FIG. **2**A (the hole h**2** will be referred to as a "connecting hole"). A conductor **13** is formed inside the connecting hole h**2**, and the plurality of circuit patterns **15** are electrically connected to each other via the conductor **13**. For example, the inside of the connecting hole h**2** is metal-plated. Although the conductor **13** has a tubular shape in the example of the electronic equipment **1**, the conductor **13** may be formed in such a manner as to fill the connecting hole h**2**. The connecting hole h**2** is, for example, a through hole that penetrates the circuit board **10** as illustrated in FIG. **2**A. Unlike this, the connecting hole h**2** may be a recess that does not penetrate the circuit board **10**. The circuit board **10** further has through holes h**1** for forming heat conduction paths **11** which will be described later.

[0016] As illustrated in FIG. **1**, an electronic component is disposed on the upper surface (first surface) of the circuit board **10**. The electronic component is, for example, a heat generating component that generates heat during operation. In the example of the electronic equipment **1**, an integrated circuit apparatus **5**, which is a heat generating component, is disposed on the circuit board **10**. The integrated circuit apparatus **5** is, for example, a microprocessor, a memory, an analog signal processing circuit, or other components but is not limited thereto. Also, the integrated circuit apparatus **5** may be a system in package (Sip) having a plurality of integrated circuit (IC) chips (silicon die) sealed inside a single package. In this case, the integrated circuit apparatus **5** may be a Sip having a plurality of IC chips arranged horizontally side by side or a Sip having a plurality of IC chips arranged vertically side by side. In the example illustrated in FIG. **1**, the integrated circuit apparatus **5** has two IC chips **5***c* and **5***d* that are vertically stacked one on top of the other. An electronic component susceptible to temperature effects may be disposed on the circuit board **10** in place of the integrated circuit apparatus **5**. Examples of such